TRENDS IN DENTAL SCIENCES

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ONLY within recent years has dentistry come to accept an ever-broadening scope of responsibility and to anticipate the opportunities in its expanding horizon. Empiricism has given way to the scientific method, and a broad base of research is acknowledged to be fundamental to the solution of dental problems.

It is not enough, however, that the concept of dental research be broad. A constant awareness of the relation of known scientific data to dental disease and abnormalities is a prerequisite for the scientist who would serve dentistry, and proper application of such knowledge is essential to dentistry's progress as a health profession.

Need for Greater Impetus

Notable in our country's history of human ills has been the increasing magnitude of oral and related health problems, reflected in a current annual national dental health bill of $2.4 billion. Nevertheless, education and research in the sciences relevant to oral health are not advancing with sufficient rapidity to apply the full potential and scope of modern science to the prevention and cure of oral disease and malfunction.

The proved significance of fluorides in drinking water as related to dental caries prevention, together with the acceptance of this public health measure by communities throughout the United States, is the result of more than two decades of laboratory, clinical, and epidemiologic research. However, relatively little progress has been made toward the fundamental understanding of the causes of dental decay or the factors which provide immunity. Although research in the germ-free laboratory has established that bacteria are essential in pathogenesis, the complex interrelationships of microflora, diet, and heredity remain inadequately defined.

Similarly, periodontal disease probably is not a single entity, but rather a complex of diseases that affect the supporting structures of the teeth. Although epidemiologic studies continue to contribute to a better understanding of prevalence and severity in selected population groups and provide some elucidation of the significance of socioeconomic and nutritional factors, considerably greater attention must be given to basic studies. In oral microbiology, for example, the role of bacteria in pathogenesis and the cellular and humoral mechanisms of host resistance must be more clearly defined. In biochemistry, there must be better understanding of enzyme relationships to periodontal tissue breakdown and the mechanisms of collagen degeneration and maturation.

In the important area of abnormal oral-facial growth and development, particularly malocclusion and cleft palate, significant advances have been made in corrective procedures and techniques. However, a clear understanding of the complex etiological factors as related to heredity and maternal-intrauterine environment can be gained only through an increasing participation by scientists in such fields as developmental and molecular biology and biochemical genetics.

Opportunities and Trends

In considering steps to accelerate the development of new knowledge, and thereby broaden dentistry's horizons and end much of its remaining artificial but traditionally structured separation from the total body of the biological and medical sciences, there must be a realistic approach to identification of program objectives and reasonable methods for assessing

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progress. It is important that these efforts keep in sharp focus a continuing responsibility to give emphasis to the major health problems of dental caries, periodontal disorders, and abnormalities of growth and development.

In approaching such disease-oriented programs, important responsibility falls to the scientist whose quest is for fundamental knowledge without regard for immediate applicability to disease problems. Afforded a proper environment, there should be no need to justify why efforts to understand fully the pathogenesis of dental caries are paralleled by attention to the broad and complex field of calcification. Likewise, developmental biology, neuromuscular physiology, and enzyme systems in genetics need not be justified as basic to the study of orthodontics and oral-facial malformations. Nor should there be any question of how investigations of the molecular structure of collagen and the chemistry of connective tissue contribute to the study of periodontal disease.

A considerable range of additional interests and responsibilities may be related to the dental sciences. For example, at the aggregate as distinct from the unit level, increasing attention must be directed toward the important neuromuscular activities centered around the oral region and the role which the brain stem segments of the nervous system play in the sensory-motor integration of all the intricate coordinate movements in the oral area. In particular, emphasis should be given to the mechanisms in the integrative management of feeding, drinking, chewing, swallowing, salivary, and other digestive activities, and, in general, to the role of the entire oral region in diet and nutrition.

Broad vistas are opening also for study of man's ability to communicate emotion and express pleasure or pain, with oral-pharyngeal and facial mechanisms serving vocalization, grimacing, laughter, and crying. Toothache has, through history, accounted for a major category of man's discomfort, yet central neural mechanisms for pain and the subjective experience of emotion, whether enjoyable or unpleasant, continue to be enigmatic. Importantly related to these fields are the sensory mechanisms of taste and smell, especially their biochemical, biophysical, and psychological foundations.

Oral-pharyngeal activities involving the respiratory structures, together with the larynx, tongue, and lips, serve man's unique behavioral capability of communicating with his fellow man by the codes and symbols of sound patterns we call speech. Major contributions await the application of dental research to the problems of phonetics, the central neural mechanisms for speech and communication, and speech pathology and its therapy.

In another broad field of research, energetic efforts over 15 years have sought to adapt the products of the plastics industry to prosthetic devices for arteries, blood vessels, and heart valves. Similar approaches are only now being developed for restorative dentistry. Obviously, formulation of a satisfactory material for tooth restoration must be based upon detailed knowledge of the structural and chemical properties of the biological substrates and the special characteristics of instrumentally prepared surfaces. Such studies, including crystalline reactivity as well as the nature and properties of the organic matrices underlying tooth mineral, are leading to the prospect of early development of filling materials having organic and inorganic bonding properties. To meet this program goal there must be significantly increased partcipation from such relevant fields as metallurgy, biophysics, physical and colloid chemistry, and crystallography.

Currently, bioengineering does not usually encompass dental areas. It remains for the engineering and allied physical sciences to be challenged sufficiently by the oral biologist. Awaiting attention in the dental sciences are newer approaches to prosthetic reconstruction for maxillofacial defects, particularly to metal and polymer implants, and the formulation of newer principles of design aimed at improving mastication and speech. The potential of affiliation with bioengineering is evident in the medical achievements resulting from the collaboration between medical scientists and engineers, especially in electronic instrumentation.

Research Institutes

A variety of approaches may be used as accelerating forces in the development of study categories designed to cope with the increasing

magnitude of oral health problems. However, the setting in which such research would best flourish is in centers of excellence that would engage and coordinate a broad front of science disciplines. These organized units or institutes could be established strategically in universities which have a favorable climate for an effective coupling of a full range of scientific strengths, with enhancement of graduate training in appropriate disciplines. Here, ready access would be provided to the entire breadth of the university rather than the restricted base inevitable within a single professional school.

If dentistry is to be saved from movement into pure technology, a training component must be available to persons who represent the sources of future dental scientists. This component would embrace the ability to draw into oral health-oriented research young persons from other biomedical and physical science disciplines who may not be aware of some of the scientific challenges in dental research.

In the establishment of dental research institutes, an essential criterion for creating new space must not be derived from the university's teaching obligations, but rather should reflect the optimum environment for the programs of research and research training that each institution would develop. Particularly important is that the centers not simply expand what has been done in the past but rather represent a new approach that would build on existing strengths, provide for participation of multiple disciplines, facilitate cooperation of a broad range of sciences in the study of problems of common interest, and interact with the educational programs of the parent university.

Addressing itself to the delineated problems and objectives, the National Institutes of Health, during the past year, initiated a broadly conceived program designed to explore and define in university settings those special considerations and requirements that will ultimately insure that the unique purposes of dental research institutes, wherever established, will be appropriately served. This effort is making it clear that dentistry's attainments of tomorrow will be a direct consequence of the extension of the boundaries of knowledge and that this progress will come about only coincident with the uniting of the health professions and related sciences in appropriate environments.

Dr. Gehrig Is Deputy Surgeon General

Dr. Leo J. Gehrig has been appointed deputy surgeon general of the Public Health Service. Dr. Gehrig was the first medical director of the U.S. Peace Corps before his assignment as chief of the Bureau of Medical Services, a post he assumed in April 1964.

A native of Duluth, Minn., Dr. Gehrig received an M.D. degree from the University of Minnesota Medical School and was commissioned in the Service in 1945. After completing an internship at the County General Hospital, Salt Lake City, Utah, he served as acting director of tuberculosis control with the Alaska Department of Health.

From 1947 to 1950, Dr. Gehrig was a resident physician in thoracic surgery at the Overholt Thoracic Clinic, Boston, Mass. He became chief of thoracic surgery at the Public Health Service Hospital, Staten Island, N.Y., in 1951 and was named deputy chief of surgery at the Service hospital, Seattle, Wash., in 1955. In 1957 he came to Washington, D.C., as deputy chief of the Division of Hospitals.

Dr. Gehrig is a diplomate of the American Board of Surgery and the American Board of Thoracic Surgery, and a member of the Alpha Omega Alpha Honor Medical Society.